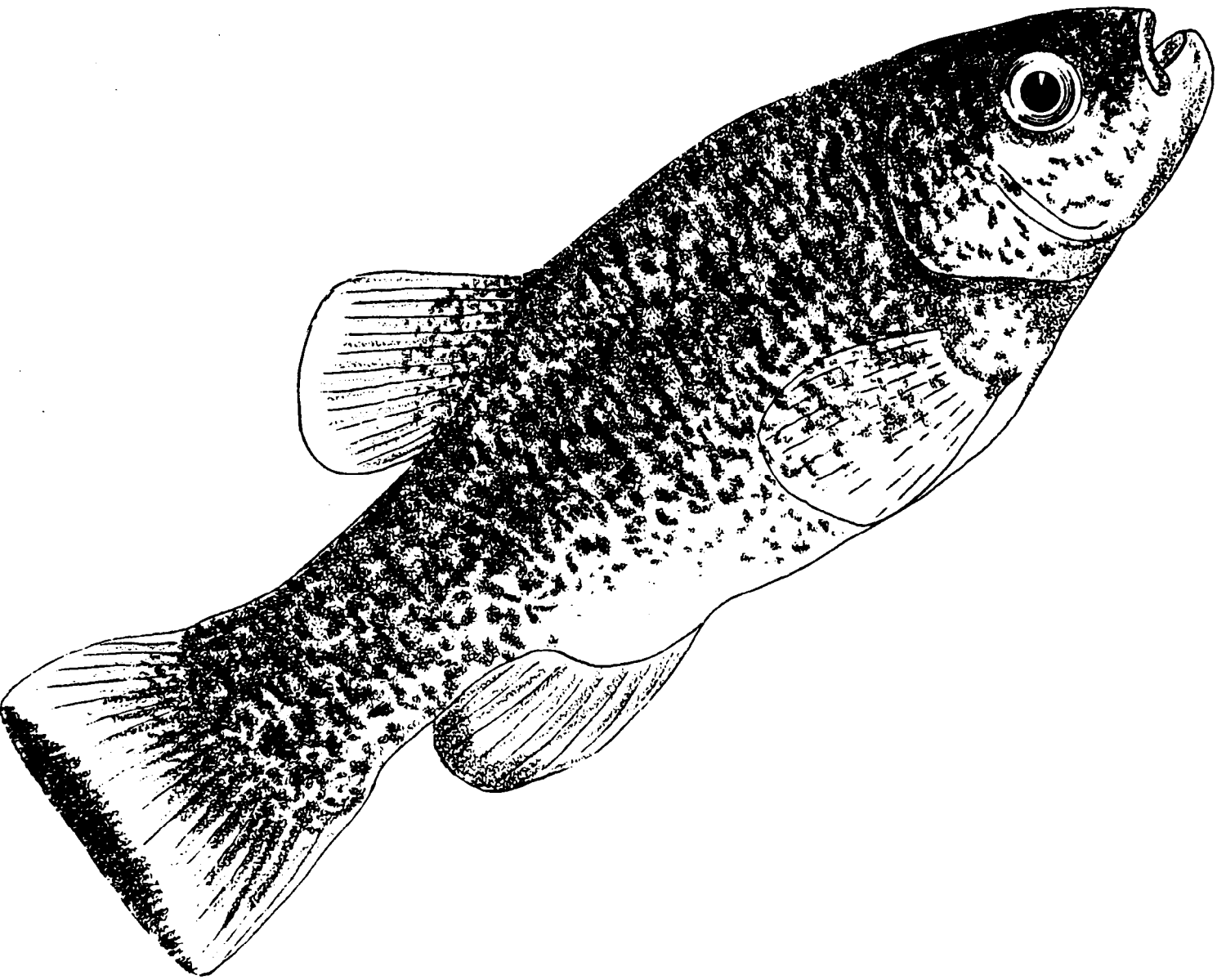
COMANCHE SPRINGS PUPFISH RECOVERY PLAN



1981

RECOVERY PLAN

FOR THE

COMANCHE SPRINGS PUPFISH

PREPARED BY THE

RIO GRANDE FISHES RECOVERY TEAM

APRIL 20, 1981

TEAM MEMBERS

Dr. Clark Hubbs, Team Leader
Department of Zoology,
University of Texas, Austin, TX

Dr. Anthony Echelle, Biological Sciences,
Oklahoma State University, Stillwater, OK

Dr. Salvador Contreras-Balderas,
Facultad de Ciencias Biologicas
Universidad Autonoma de Nuevo Leon
Ciudad Universitaria, Monterrey, N.L., Mexico

Mr. Michael D. Hatch,
New Mexico Department of Game and Fish
Sante Fe, NM

Mr. Floyd E. Potter, Jr.
Texas Parks and Wildlife Department, Austin, TX

Mr. Buddy Jensen
U.S. Fish and Wildlife Service, Dexter, NM

Approved:

Acting Deputy

By F. Eugene Hester

Director
U.S. Fish and Wildlife Service

Date 9-2-81

DISCLAIMER SHEET

The Comanche Springs Pupfish Recovery Plan was developed by the Comanche Springs Pupfish Recovery Team, an independent group of biologists sponsored by the Albuquerque Regional Director of the U.S. Fish and Wildlife Service.

The recovery plan is based upon the belief that State and Federal conservation agencies and knowledgeable, interested individuals should endeavor to preserve the Comanche Springs pupfish and its habitat and to restore them, as much as possible, to their historic status. The objective of the plan is to make this belief a reality.

The recovery team has used the best information available to them and their collective knowledge and experience in producing this recovery plan. It is hoped the plan will be utilized by all agencies, institutions, and individual6 concerned with the Comanche Spring6 pupfish and its habitat in coordinating conservation activities. Periodically, and as the plan is implemented, revisions will be necessary. Revisions will be the responsibility of the recovery team and implementation is the task of the managing agencies, especially the Texas Park6 and Wildlife Department and the U.S. Fish and Wildlife Service.

This completed Comanche Springs Pupfish Recovery Plan ha6 been approved by the U.S. Fish and Wildlife Service. The plan does not necessarily represent official positions or approval6 of cooperating agencies and does not necessarily represent the views of all recovery team members. This plan is subject to modification as dictated by new finding6 and change6 in species status and completion of tasks assigned in the plan. Coals and objective6 will be attained-and fund6 expended contingent upon appropriation6 , priorities, and other budgetary constraints.

Literature citation6 should read as follows:

U.S. Fish and Wildlife Service. 1980. Comanche Springs Pupfish (Cyprinodon elegane) Recovery Plan. U.S.. Fish and Wildlife Service, Albuquerque, New Mexico. 25 pp.

ACKNOWLEDGEMENTS

The recovery team received valuable assistance from Delbert Mooney, Soil Conservation Service, Balmorhea, Texas. Personnel of the Bureau of Reclamation and the Reeves County Water District #1 provided considerable insight into their agencies' activities and concerns in the area.

We are grateful to Mr. Joe Kingston for his hospitality and cordiality during our visits to the area. We received similar responses from numerous other residents of Balmorhea and Toyahvale who share our concern for the disappearing springs in West Texas.

TABLE OF CONTENTS

RECOVERY PLAN FOR THE COMANCHE SPRINGS PUPFISH

PART 1

INTRODUCTION

The Comanche Spring6 pupfish (Cyprinodon elegans) was listed as an endangered species, as defined in Section 4 of the Endangered Species Act of 1973, in the "Federal Register," Vol. 32:4001, on March 11, 1967. The species 16 protected also under Chapter 68 of the Texas Parks and Wildlife Code and is listed as an endangered species by the American Fisheries Society, Texas Organization for Endangered Species, and the International Union for the Conservation of Nature.

Description

Cyprinodon elegans is one of the two most distinctive species of the 12-14 species of pupfishes in the United States; the other is the endangered Devils Hole pupfish (C. dlabolls). The most striking character setting C. elegans apart from all other Cyprinodon species is the peculiar "speckled" color pattern of the male (Stevenson and Buchanan 1973, Echelle and Hubbs 1978). Other distinguishing character6 of C. elegans are a more streamlined body form than 16 usual for the genus and the lack of vertical bars. Liu (1969) also noted the unique combination of behavioral characters of C. elegans, nd Itzkowitz (1969) emphasized the unusual ability of the-Phantom Lake Spring population to breed in relatively swift-flowing water.

Local Differentiation

Extant populations of C. elegane show local differentiation in body form and in degree of ventral scalatlon, and they differ in several morphological features from specimens taken 40 years ago from a population (now extinct) at the type locality, Comanche Springs (Echelle 1975). Among extant populations, specimen6 from Phantom Lake Spring and Toyah Creek differ from each other in degree of belly scalation and number6 of dorsal and caudal fin rays. The Giffin and San Solomon Spring6 population6 are intermediate.

Historical Distribution and Abundance

Cyprinodon elegans historically occurred in two isolated spring systems 190 km apart in the Pecos River drainage of southwestern Texas. These springs include (1) the type locality, Comanche Springs, with the headwaters (now dry) within the present city limits of Fort Stockton, Pecos County, Texas, and (2) a system of interconnected springs near Balmorhea, Reeves County, Texas

(Miller 1961). The large flow of Comanche Springs was used a6 early as 1875 to irrigate more than 6,000 acres of farmland (Brune 1975). Because of a lack of downstream collection data, C. elegans is only known to have occurred in the headwater area. However, based on observations of present populations, the species likely occurred in downstream areas.

Prior to major human alteration beginning at the turn of the century, the system of large artesian springs near Balmorhea (Fig. 1) probably supported a large population of the pupfish. San Solomon and Giffin Springs formed an extensive, shallow marsh draining into Toyah Creek about 7 km WSW of Balmorhea, and flow from Phantom Lake Spring emptied into Toyah Creek a few kilometer6 west of San Solomon and Giffin Springs (White et al. 1938). Several small gravity-fed springs (Saragosa, East Sandia, and West Sandla) at Balmorhea also formed marshes that probably Supported population6 of the species. Toyah Creek was, and still is, a flood tributary of the Pecos River. The Pecos River proper is occupied by another pupfish, Cyprinodon pecosensls, and it is unlikely that the river has supported C. elegans in recent times (Echelle and Echelle 1978).

Present Distribution and Abundance

The pupfish in Comanche Springs was extirpated (Hubbs 1957) when the springs went dry in 1955 (Brune 1975). At present, the species occurs primarily in an irrigation system fed by Phantom Lake and in Giffin and San Solomon Spring6 (Pig. 1). A few individual6 of the species occasionally occur in Toyah Creek (Echelle 1975).

The present habitat of the species consists mostly of a system of earthen and concrete irrigation canals. The water from Phantom Lake Spring is diverted into agricultural field6 or sometime6 flows down Phantom Lake Canal to merge with the flow from San Solomon Spring. The combined flow then enters either of two major distributaries: one empties into an artificial reservoir (Lake Balmorhea), and the other, after merging with a canal from Glffln Spring, passes along Highway 290 through the north side of Balmorhea. The pupfish population is sparse in most of the Canal system, but the species occasionally is numerous (upto200 young-of-year and adults in single seine hauls) in short segments. The pupfish occurs sporadically near the mouth of a concrete irrigation flume of an earthen canal entering Lake Balmorhea.

Reasons for Decline

All large springs of West Texas have failed or are failing (Brune 1975). Mining of underground water for municipal and agricultural purposes has lowered the water table and reduced spring flows. The failure of Comanche

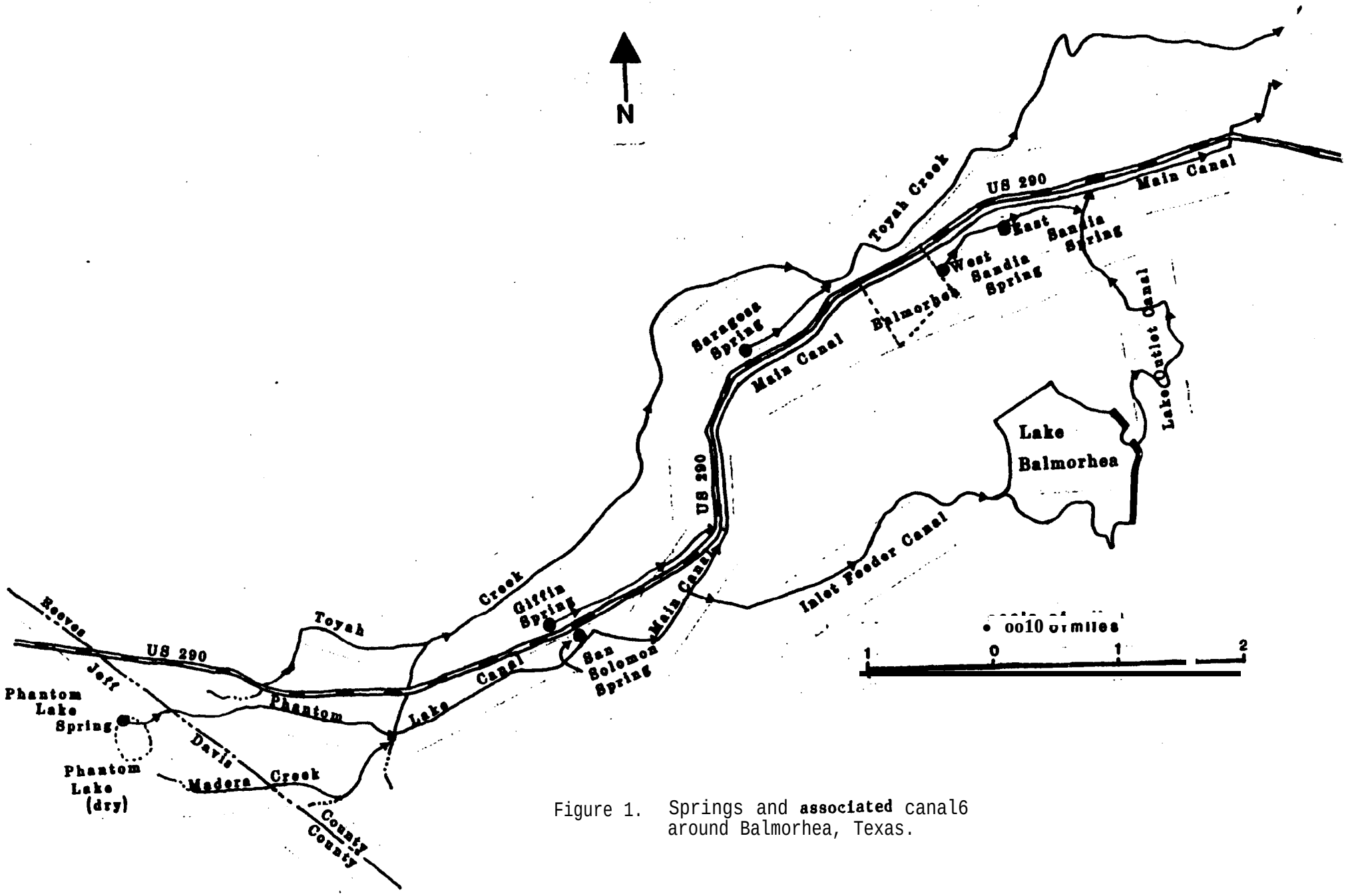


Figure 1. Springs and associated canal6 around Balmorhea, Texas.

Springs (the type locality of C. elegans) during the 1950's caused the loss of approximately one-half-of the presumed historic habitat of the pupfish. The Comanche Springs pupfish population in the Balmorhea area also was reduced in size when settlers modified the spring system for irrigation purposes in 1875 (Brune 2975). Physical modification of thr springs and associated marshy habitats has been extensive. Many canal6 were constructed throughout the area to divert spring flow into surrounding fields (Fig. 1). The canals caused drying of the marshes and hastened exit of water from the spring area. Local pumping of groundwater lowered the water table, and flow from the springs declined markedly since the early 1900'6 (Brune 1975). Virtual elimination of spring and marsh habitat undoubtedly reduced the size of the pupfish population.

Ecology

Cyprinodon elegans is known only from freshwater habitats. The springs near Balmorhea have salinities up to about one part per thousand (ppt), a6 did the now dry Comanche Springs (Brune 1975). Other pupfishes in the Pecos River system (C. bovinus and C. pecosensis) occupy more saline water6 (e.g., 10 ppt or above). Based on this information, Echelle and Echelle (1978) suggested that C. elegans has a long history of ecological isolation from other Pecos River pupfishes.

The ecology of C. elegans is described principally from field observations. Spawning occurs in stenothermal spring outflow6 (Ikzkowitz 1969) and in small, eurythermal pool6 of standing water. In irrigation canals, the species is most abundant in shallow areas With low current velocities. Cehlbach et al. (1978) reported Critical Thermal Maxima (CTM) of aquarium-held individuals to be 40.4 C and 39.6 C. These temperature6 are similar to those reported for other Cyprinodon species in a variety of thermal habitat6 (Brown and Feldmeth 1971).

Several studies (e.g., Martin 1972, Echelle 1975, Humphries and Miller 1981) demonstrated adaptation of other Cyprinodon species to simple communities consisting of few predator6 and competing species. A6 expected of fishes in simple communities, C. elegans ha6 broad ecological characteristics; for example: (1) feeding-occurs mostly on the bottom, but also at the surface and at other levels in the water column; (2) based on consistent occurrence of small specimens, breeding apparently occurs during most month6 of the year; (3) spawning occurs in area6 of flowing water a6 well in stagnant pools, and (4) survival and reproduction occur in both stenothermal spring outflow6 and in eurythermal pools.

Major Threat6

There are three major threat6 to C. elegans: (1) competition with introduced species; (2) degradation of-genetic integrity caused by hybridization with introduced congeners; and (3) habitat loss from declining springflow and reduced surface waters. Management methods to overcome or circumvent these threat6 are included in the recovery outline.

(1) Competition: Since C. elegans appears relatively generalized in ecological needs, almost any co-occurring species of fish, either indigenous or introduced, potentially would exert competitive pressure on the pupfish population. Competition with Introduced Cyprinodon species poses an especially serious threat. Abundance and distribution data indicate C. elegans is more successful in the environment of Lake Balmorhea than C. variegatus. C. elegans has a long history in sprlngfed environments, while C. variegatus evolved in highly unstable, eurythermal habitats. Presumably, C. elegans would be more successful than C. variegatus in stenothermal-spring outflows, whereas C. variegatus would exclude C. elegans from presently occupied, unstable habitats upstream from Lake Balmorhea.

The most abundant species in microhabitats supporting large numbers of C. elegans are Gambusia geiseri (introduced species--Hubbs 1981), Dionda episcopa, and G. nobilis near the heads of Phantom Lake and Giffin Springs. Seine hauls in the outflow from Phantom Lake Spring often contain only these four species. Canals fed by Giffin and San Solomon Springs support a variety of species In addition to those just mentioned, including Astyanax mexicanus, Ictalurus punctatus, G. affinis, Cichlasoma cyanoguttatum, Lepomis megalotis, and L. cyanellus. Depending on the microhabitat in these areas, relative abundance of pupfish ranges from absent to most abundant species present.

A variety of fishes has been collected from Toyah Creek; these include all those mentioned above, excepting G. nobilis, and two additional species, Notropls lutrensls and Fundulus kansae (introduced species--Hubbs 1981). The pupfish is generally uncommon In Toyah Creek. At Lake Balmorhea, C. elegans occurs almost entirely in or near a small area at the mouth of a cement irrigation flume. The flume empties Into an inflow canal about 5 m wide and 100-200 m long, depending on lake level. The earthen canal supports a variety of other fishes, including Notropis lutrensis, Dionda episcopa, Pimephales promelas (Introduced species--Hubbs 1981), Notemigonus crysoleucas (introduced species--Hubbs 1981), Cyprlnus carpio (introduced species--Hubbs 1981), Astyanax mexicanus, Ictalurus punctatus, Gambusia nobilis, G. geiseri (introduced species--Hubbs 1981), G. afflnis, Menidia beryllina (introduced species--Hubbs 1981), Cyprinodonvariegatus (introduced species--Hubbs 1981), Fundulus grandis (introduced species--Hubbs 1981), Lepomis macrochirus, L. cyanellus, and L. humilis. These species probably came from three major sources:(1) movement downstream from springfed waters ; (2) introductions by man from inland areas, possibly the Pecos River; and (3) transportations by man from the Gulf Coast and/or the lower Rio Grande. C. variegatus, first found in Lake Balmorhea in the middle 1960's, presumably was introduced from the Gulf Coast, and now occupies shallow areas around the lake. In the inflow canal where hybridization occurs, C. variegatus outnumbers C. elegans by more than 10 to 1. Introductions of-coastal bait fishes continue. For example, Fundulus

grandis was first taken in the summer of 1977; a rotenone operation of the lake conducted by the Texas Parks and Wildlife Department in 1979 yielded large numbers of F. grandis (D. J. Morris, pers. comm.).

(2) Hybridization: Cyprinodon elegans exhibits little premating reproductive isolation when artificially brought into contact with introduced pupfishes. This is shown clearly by the hybridization in Lake Balmorhea. Here, despite minor postmating isolation, the variegatus genome has been introgressed by elegans genes, and presumably, the elegans genome would be contaminated similarly if variegatus were established in upstream areas of the irrigation system. Potential hazards include "baitbucket" transport of other pupfishes (e.g., C. bovinus from Pecos County and C. peconsensis from the Pecos River), but the most likely source of danger continues to be introductions from the C. variegatus population in Lake Balmorhea.

Stevenson and Buchanan (1973) reported hybridization between C. elegans and introduced C. variegatus at the entrance of the earthen canal into Lake Balmorhea. They reported that in the hybrid zone all apparently pure C. elegans were females, that an aberrant sex ratio (80% females) occurred among hybrids, and that hybrid males showed evidence of sterility. Nevertheless, as is typical for pupfishes (Turner and Liu 1978), backcrossing occurs, as indicated by apparent genetic introgression in Lake Balmorhea. A 0.5 m vertical drop of water at the terminus of the inflowing concrete canal seems insurmountable by pupfishes and protects upstream populations of C. elegans from genetic contamination by C. varlegatus. The earthen canal always has a few pupfish resembling C. elegans. Such fish, based on Stevenson and Buchanan's (1973) hybrid index code, were never more than 10% (usually 5%) of any sample.

(3) Habitat loss: The large artesian springs in the Balmorhea area are diminishing in flow, and Phantom Lake Spring is failing faster than are San Solomon and Giffin Springs because its point of discharge is at a higher elevation (Brune 1975). This suggests that Phantom Lake Spring may become dry within 50 years and reiterates the prediction by White et al. (1938) that continued mining of deep-lying aquifers eventually will cause the demise of the entire Balmorhea spring system.

Much of the present Balmorhea canal system is unsuitable for the Comanche Springs pupfish. In most main canals the water flows swiftly and scours concrete-lined canals. In lateral canals, flows are dependent upon agricultural needs. Water distribution from Phantom Lake Spring into surrounding fields frequently is so extensive that little or no water occurs in the central canal in the vicinity of San Solomon Springs; this is especially true during the March 1 to October 1 irrigation season. But when irrigation needs are minimal, lateral irrigation canals are often dry. Flows in canals below San Solomon and Giffin Springs fluctuate similarly. Additionally, flows in certain major areas suitable for pupfish are occasionally diverted

to allow repair and maintenance of irrigation canals; Davis (1979) reported die-offs of the pupfish during these operations. These manipulations of water flow cause some variations in numbers and in the extent of pupflsh living space but are considered minor impediments to the survival and recovery of the pupfish when compared to habitat loss and the other major threats facing the species (see Major Threats).

Conservation Efforts to Date

The Texas Parks and Wildlife Department has constructed a small refugium at Balmorhea State Recreation Area (Fig. 2) to provide stable flowing-water habitat for a small population of C. elegans. The refugium was completed in 1974 and now supports a population of several thousand C. elegans.

The United States Fish and Wildlife Service is maintaining a genetic stock of C. elegans at the Dexter National Fish Hatchery, Dexter, New Mexico. The original stock consisted of about 30 individuals from an irrigation ditch fed by Giffin Springs. The pupfish at Dexter are being held there to provide fish for reintroduction efforts should a catastrophic loss of the natural population occur, and as, a stock from which research specimens may be taken without affecting the wild population.

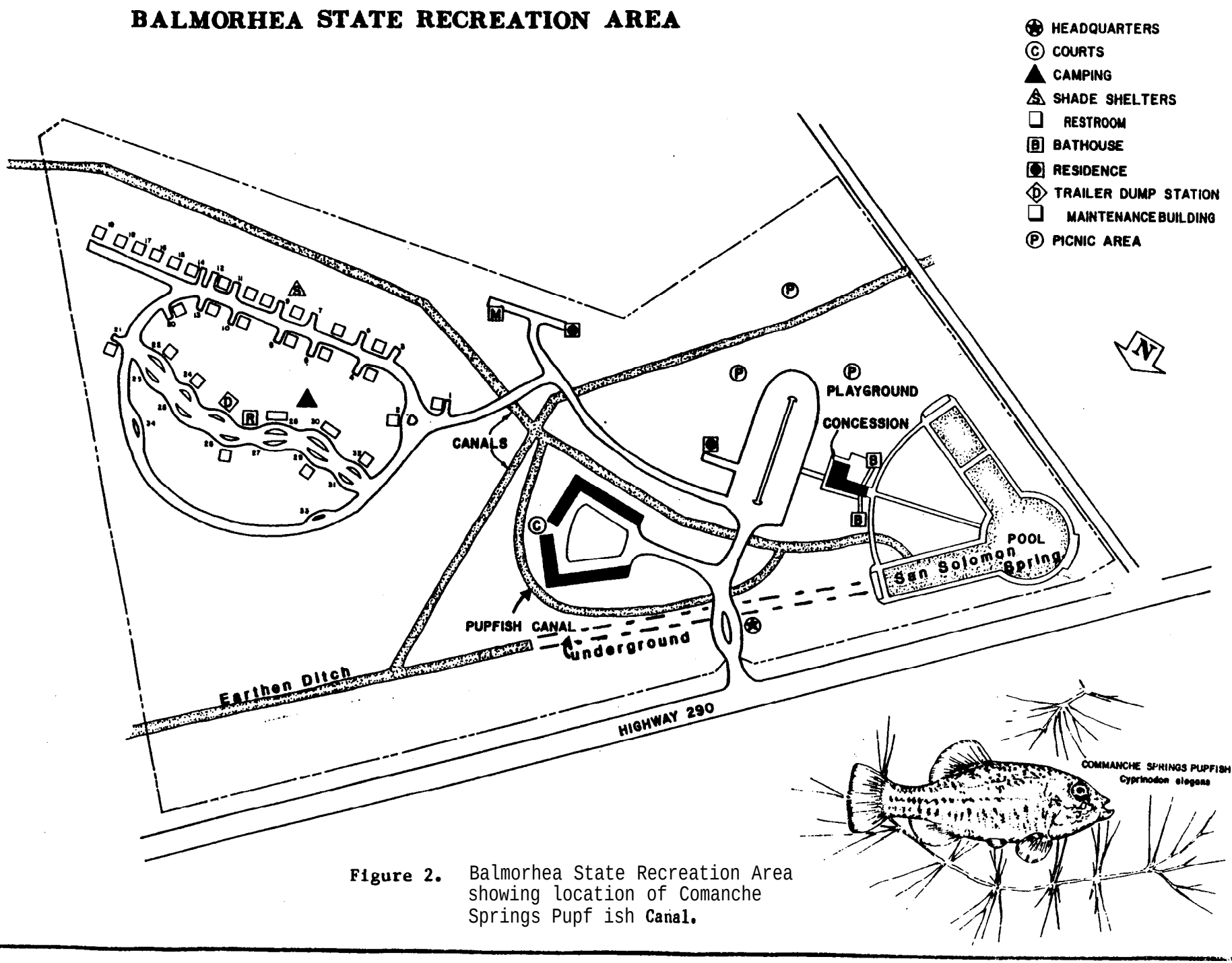


Figure 2. Balmorhea State Recreation Area showing location of Comanche Springs Pupf ish Canal.

PART II - RECOVERY

OBJECTIVES: The major goals of the recovery plan for the Comanche Springs pupfish (CSP) are as follows:

(1) To assure perpetuation of the species in its natural habitat.

(2) To assure genetic diversity of CSP by improving the quality of presently occupied habitats, by increasing the quantity of suitable habitat, and by establishing a sound, continuing program of management and public information.

(3) To downlist the species from endangered to threatened status. The restricted area of natural occurrence of the species and declining flow from the springs probably preclude eventual delisting of the species.

STEP-DOWN OUTLINE

1.0 Maintain and enhance existing CSP populations and habitats.

- 1.1 Monitor populations.
- 1.2 Monitor habitat.
- 1.3 Recanmend monitoring personnel.
- 1.4 Enhance existing habitats.
  - 1.41 Periodic flooding of irrigation ditches.
  - 1.42 Expansion of habitat at head of Phantom Lake Spring.
- 1.5 Manage CSP habitat.
  - 1.51 Enter into cooperative management agreements with private landowners and government agencies.
  - 1.52 Provide protection for certain springs, their watersheds, and their primary distributaries.
    - 1.521 Protect the downstream portion of the large earthen canal leading from the swimming pool In Balmorhea State Recreation Area.
    - 1.522 Protect Phantom Lake Spring and the upper 1 km of Phantom Lake Canal.

1.53 Conduct a thorough review of the hydrology of the Balmorhea area.
1.54 Prepare management plans.
1.55 Consider designating critical habitat.

2.0 Maintain genetic reserve of CSP at:

2.1 Dexter National Fish Hatchery.

2.2 Balmorhea State Recreation Area.

3.0 Disseminate information about CSP.

3.1 Prepare information pamphlet.

3.2 Produce motion picture.

4.0 Enforce State and Federal laws protecting CSP and its habitats.

NARRATIVE

The Comanche Springs Pupfish Recovery Team believes that implementation of the management plan described herein, especially section 1.4 and 1.54, will remove the major threats to CSP; at that time reclassification of CSP from endangered to threatened status would be appropriate. Because of the restricted area of natural occurrence of the species and declining water flow from the springs, we feel that CSP will never be delisted completely.

1.0 Maintain and enhance existing CSP populations and habitats.

At present CSP is known only from the Balmorhea area illustrated in Figure 1. Reclassification of CSP to threatened status is dependent upon management of this presently known habitat in the manner described in the recovery plan. We know of no other waters in the natural range of the species that may be suitable. Survival of the species depends entirely on its success In the Balmorhea area.

1.1 Monitor populations.

The well-being of CSP and success of management efforts should be ensured by monitoring the populations frequently. Monitoring should be done in several areas representative of the variety of habitats typically occupied by the species. Bates of sampling should be representative of periods of maximum and minimum temperatures and water usage for irrigation. The team proposes the sampling regime in Appendix A to achieve these objectives.

The team recommends monitoring in the months of July and January. The bank observations described in Appendix A should be made in the hours from 12-4:00 p.m. The seining operations may be done at anytime during daylight hours. Monitoring personnel should obtain appropriate permission from landowners before monitoring begins.

The reproductive biology of CSP, along with its relatively short life span, combine to cause relatively large fluctuations in CSP population numbers. For this reason, it is impossible to state what population level of CSP should correspond with reclassification to threatened status. Subsequently, the emphasis for recovery and reclassification is based upon enhancement of present habitat.

1.2 Monitor habitat.

Coincident with monitoring the populations, the monitoring personnel should record such things as rate of water flow, abundance and type of aquatic vegetation, changes in shoreline vegetation, and any other indicators of change in habitat quality. Monitoring personnel also should be charged with the

responsibility of noting and compiling published water flow records (e.g., USGFS publications on the springs). Data acquired should be recorded as Indicated in Appendix A.

1.3 Recommend monitoring personnel.

Monitoring efforts should be contracted to persons knowledgeable of CSP and the Balmorhea area. Contracts should specify that annual data should be compared with past findings and reported to USFWS.

1.4 Enhance existing habitats.

The existing habitat can be improved without diminishing the present level of use for irrigation. The recommendations made here should be implemented only after impacts on other endangered species (e.g., Gambusia nobilis) have been evaluated.

1.41 Periodic flooding of irrigation ditches.

At present, flow from the major springs is continuous to the Lower Park Reservoir, but many areas of marginally suitable habitat in irrigation ditches go dry during periods when water is not needed for irrigation. More stable habitat conditions and a larger living space for CSP could be obtained from flooding certain ditches at intervals during such periods. The Reeves County Irrigation District and other interested parties should be consulted to determine the feasibility of these periodic releases. Another enhancement possibility is placement of small checks in the canal below Phantom Lake Spring; these check structures would replicate present conditions just upstream of the bench flume waterway below the spring.

1.42 Expansion of habitat at head of Phantom Lake Spring.

At present, the small headpool at the mouth of Phantom Lake Spring opens directly into a narrow, concrete-lined irrigation canal largely unsuitable for CSP. Discussions with the landowner should be initiated to determine the possibility of constructing a refugium canal through the now dry Phantom Lake. The refugium canal should be designed to provide enhanced and enlarged habitat for CSP while simultaneously having little or no impact on the amont of water available for irrigation. The refugium canal should empty back into the present canal, thus providing flow to the irrigation system at all times.

1.5 Manage CSP habitat.

Management of CSP habitat will be difficult because of land ownership, water use patterns, and legal complications. Effective management will require acquisition or management easement of key areas, and perhaps, cooperative agreements between landowners and Federal and State agencies.

1.51 Enter into cooperative management agreements with private and government agencies in order to protect pupfish habitat.

Private landowners have water rights to the flow from Phantom Lake Spring. Reeves County Water District #1 owns water rights to all surface flow from San Solomon, Giffin, and lesser springs in the vicinity of Balmorhea, and the water district has bought the excess flow from the landowners of the Phantom Lake system. Lake Balmorhea is a privately owned reservoir that receives water from the irrigation system and stores it for downstream distribution.

Governmental agencies include Texas Parks and Wildlife Department, Reeves County Water District #1, Soil Conservation Service, and Water and Power Resources Service. These diverse interests will have to be consulted in the development and implementation of a comprehensive management plan.

1.52 Protect Phantom Lake Spring and the upper 1 km of Phantom Lake Canal.

The Bureau of Reclamation is thought to own 17 acres, including Phantom Lake Spring and approximately 100 meters of the adjacent outflow on the Joe Kingston ranch. The remainder of the canal is owned by Mr. Joe Kingston. The canal is concrete-lined, but good habitat for CSP is provided by two small laterals and by two irrigation "boxes" in the main canal.

1.53 Conduct a thorough review of the hydrology of the Balmorhea area.

Brune (1975) documented declining springflows in the Balmorhea area. The underground aquifer that supplies the springs is limited by the amount of recharge. As mining (= pumping) of groundwater increases, springflows will decline. Efforts should be made to provide for perennial flow of water from Phantom Lake, San Solomon, and Giffin Springs.

Scudday (1977) documented the economic futility of pumping artesian water in a situation similar to Balmorhea, the Fort Stockton area of Texas: "Nine thousand low-overhead, productive acres (previously irrigated by the now dry Comanche and similar springs) were swapped for 10 or 11 thousand very expensive-to-water acres (watered by pumping of ground water)."

Increased mining of water in the Balmorhea area will impact the pupfish habitat and the present irrigation system. A thorough study of the hydrology and water needs in the Balmorhea area is needed. The extent of the aquifer supplying the Balmorhea area and the associated recharge zones are not well understood. Once such a study is completed, a list should be compiled which gives numbers of wells and estimates of water removed in different parts of the Balmorhea area. This would indicate the extent of groundwater is mined and would serve as a point of reference for future assessments. Local councils of government should be contacted for projections of future water needs.

1.54 Prepare management plans.

This recovery plan provides general guidelines for the recovery of CSP. Specific management efforts emphasizing habitat improvements are not detailed in this plan but should be prepared within the guidelines provided. A management plan should be prepared that details specific management practices and designates agency responsibilities. The Water and Power Resource Service has an interest in an important section of CSP habitat and, therefore, should cooperate with the USFWS in developing the plan. The plan should consider other endangered species, such as Gambusia nobilis.

1.55 Consider critical habitat.

No advantage to survival of CSP will accrue from designation of essential or critical habitat for the species. The concept of critical habitat is often misunderstood and its designation is likely to disrupt present harmonious relations.

2.0 Maintain genetic reserve of CSP.

Large, viable populations of CSP representing a small portion of the total genetic variation of the species have been maintained in artificial

habitats. They could provide valuable genetic stock, if reintroductions become necessary, and could provide opportunities to study culturing methods, behavior, and ecological needs of the species.

2.1 Dexter National Fish Hatchery.

Propagation of CSP in hatchery ponds at Dexter should continue indefinitely. The present population consists of thousands of fish and would be adequate for purposes given in 2.0.

2.2 Balmorhea State Recreation Area.

The population of CSP in the Balmorhea refugium should be maintained. The refugium, in association with other park facilities, provides an ideal opportunity to increase public awareness of the pupfish, its survival problems, and the survival problems generally faced by all endangered species.

3.0 Disseminate information about CSP.

Besides providing an educational service, a good information program can encourage public support for protection of the species. Balmorhea State Recreation Area provides an excellent opportunity to increase public awareness. Information should be disseminated to as varied an audience as possible.

3.1 Prepare information pamphlet.

A pamphlet should be prepared describing CSP, its general biology, and general aspects of the recovery effort.

3.2 Produce motion picture.

A 15-20 minute film should be prepared describing the desert ecosystem of the Balmorhea area. The pupfish and other endangered species of the area should be highlighted, emphasizing the uniqueness and endangered status of the entire aquatic ecosystem. The history of Comanche Springs and the economic and ecological impact of excessive mining of groundwater could be included.

4.0 Enforce State and Federal laws protecting CSP and its habitats.

CSP is protected by the Department of Interior and the State of Texas. Agencies or groups with present or proposed projects in the Balmorhea area should be advised of the status of CSP so that unintentional infraction of laws or inadvertent destruction of fish or habitat is avoided.

LITERATURE CITED

Brown, J. H. and C. R. Feldmeth. 1971. Evolution in constant and fluctuating environments: thermal tolerances of desert pupfish (Cyprinodon). Evolution 25:390-398.

Brune, G. 1975. Major and historical springs of Texas. Texas Water Development Board, Report 189:1-94.

Davis, J. R. 1979. Die-offs of an endangered pupfish, Cyprinodon elegans (Cyprinodontidae). Southwest. Nat. 24:534-536.

Echelle, A. A. 1975. A multivariate analysis of variation in an endangered fish, Cyprinodon elegans, with an assessment of populational status. Texas J. Sci. 26: 529-538.

_____ and A. F. Echelle. 1978. The Pecos River pupfish, Cyprinodon pecosenisis n. sp. (Cyprinodontidae), with comments on its evolutionary origin. Copeia 1978:569-582.

_____ and C. Hubbs. 1978. Haven for endangered pupfish. Texas Parks and Wildlife Magazine 36:9-11.

Gehlbach, F. R., C. L. Bryan and H. W. Reno. 1978. Thermal ecological features of Cyprinodon elegans and Gambusia nobilis, endangered Texas fishes. Texas J. Sci. 30:90-101.

Humphries, J. M. and R. R. Miller. 1981. A remarkable species flock of pupfishes, genus Cyprinodon, from Yucatan, Mexico. Copeia, 1981:52-64.

Hubbs, C. 1957. Distributional patterns of Texas fresh-water fishes. Southwest. Nat. 2:89-104.

_____. 1981. Occurrence of exotic fishes in Texas waters. Pearce-Sellards Texas Memorial Museum Series. In press.

Itzkowitz, M. 1979. Observations on the breeding behavior of Cyprinodon elegans in swift water. Texas J. Sci. 21:229-231.

Liu, R. K. 1969. The comparative behavior of allopatric species (Teleostei-Cyprinodontidae: Cyprinodon). Ph.D. thesis. Univ. California, Los Angeles.

Martin, F. D. 1972. Factors influencing local distribution of Cyprinodon (Pisces: Cyprinodontidae). Trans. Amer. Fish. Soc. 101:89-93.

Literature Cited cont.

Miller, R. R. 1961. Man and the changing fish fauna of the American Southwest. Pap. Mich. Acad. Sci., Arts and Letters 46:365-404.

Scudday, J. F. 1977. Some recent changes in the hepetofauna of the northern Chihuahuan Desert. In: (Wauer and Riskind, eds.) Transactions of the Symposium on the Biological Resources of the Chihuahuan Desert Region United States and Mexico. National Park Service Transactions and Proceedings Series, No. 3:513-522.

Stevenson, M. M. and T. M. Buchanan. 1973. An analysis of hybridization between the cyprinodont fishes Cyprinodoa variegatus and C. elegans. Copeia 1973:682-692.

Turner, B. J. and R. K. Liu. 1977. Extensive interspecific genetic compatibility in the new world killifish genus Cyprinodon. Copeia 1977: 259-269.

White, W., H. Gale *and* S. *Nye.* 1938. Ground-water resources of the Balmorhea area in western Texas. Texas Water Development Board, Misc. Publ., No. 11.

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY1 (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY FWS REGION (6)	RESPONSIBLE AGENCY FWS PROGRAM (6a)	RESPONSIBLE AGENCY OTHER (7)	FISCAL YEAR COSTS (EST.) FY81 (8)	FY82	FY83	COMMENTS (9)
M3	Maintain and enhance population and habitat	1.0	2	ongoing	2	mgmt.	TPWD*				composed of tasks 1.1 to 1.54.
I6	Monitor populations	1.1	2	ongoing	2	mgmt.	TPWD	1,000	1,000	1,000	
12	Monitor habitat	1.2	2	ongoing	2	mgmt.	TPWD	1,000	1,000	1,000	
MF	Recommend monitoring personnel	1.3	2	1 yr.	2	mgmt.	TPWD	1,000	1,000	1,000	
M3	Enhance existing habitat	1.4	3	ongoing	2	mgmt.	TPWD & BR	1,000	1,000	1,000	
11	Flooding of irrigation ditches	1.41	3	ongoing	2	mgmt.	TPWD & BR				
M2	Expand habitat	1.42	3	2 yrs.	2	mgmt.	TPWD	1,000	1,000		
M3	Manage habitat	1.5	3	ongoing	2	mgmt.	TPWD				Composed of tasks 1.5 to 1.54.
A3	Cooperative agreements)	1.51	3	ongoing	2	mgmt.	TPWD & BR		5,0001		
M3	Protect existing habitat	1.52	3	ongoing	2	protection	TPWD & BR	2,000;	5,000		
13	Review of hydrology	1.53	3	1 yr.	2	research1	USGS TPWD		10,000		

*Texas Parks and Wildlife Department

PART III cont.

GENERAL CATEGORY1 (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY FWS REGION (6)	RESPONSIBLE AGENCY FWS PROGRAM (6a)	RESPONSIBLE AGENCY OTHER (7)	FISCAL YEAR COSTS (EST.) FY81 (8)	FY82	FY83	COMMENTS (9)
M3	Prepare management plan	1.54	3	1 yr.	2	mgmt.	BR				
Ml	Maintain genetic research	2.0	3	ongoing	2	propaga-tion					(composed of tasks 2.0 to 12.2.
Ml	Dexter NFH	2.1	3	ongoing	2	propaga-tion	TPWD	5,000	5,000	5,000	
Ml	Balmorhea State Recreation area	2.2	3	ongoing	2	propaga-tion	TPWD	1,000	1,000	1,000	
01	Disseminate informa-tion	3.0	3	ongoing	2	education	TPWD				composed of tasks 3.0 to 3.1
01	Prepare information pamphlet	3.1	3	1 yr.	2	education	TPWD			2,000	
M2	Produce motion picture	3.2	3	1 yr.	2	education	TPWD			2,000	
02	Enforce laws	4.0	3	ongoing	2	enforce-ment	TPWD			5,000	

*Texas Parks and Wildlife Department

PART IV

COMMENTS AND RESPONSES

United States Department of the Interior
WATER AND POWER RESOURCES SERVICE
SOUTHWEST REGION
COMMERCE BUILDING, 714 S. TYLER
AMARILLO, TEXAS 79101

IN REPLY
REFER TO: 150

MAR 3 1981

Memorandum

To: Regional Director, U.S. Fish and Wildlife Service, Post Office Box 1306, Albuquerque., NM 87103

From: Regional Director

Subject: Review of Comanche Springs Pupfish Recovery Plan; Water and Power Resources Service Recommendations for Critical Habitat (Our Memorandums of December 22, 1980, and January 23, 1981)

Enclosed for your information is correspondence relating to our recommendations for critical habitat for the Comanche Springs pupfish. Our comments on the draft recovery plan are below.

In general, the recovery plan fails to address, with specifics, the immediate needs of the pupfish. In order to ensure that at least some habitat essential to the conservation of the species is fully protected, the Water and Power Resources Service (Water and Power) has recommended that Phantom Lake Spring and that portion of the bench flume on Water and Power property (about 100 yards) be designated critical habitat. This action would not require purchase of land, and in our opinion, little or no change in the existing operation and maintenance procedures would be necessary. . With timely consultation and coordination with the local entities involved, as well as Water and Power, a management plan for this segment of pupfish habitat could be developed in very short order. In fact, it would be advantageous to include a completed management plan as part.of the recovery plan. The hydrology of the area is already well documented, and much population data has already been collected. What is needed now are some concrete proposals upon which to act.

A-1 Page 5, second paragraph - It is important to note that rarely do flows from Phantom Lake Spring reach the vicinity of San Solomon Springs during anytime of the year and not just during the irrigation season. The flows from Phantom Lake Spring have averaged 5.3 ft^3/s over the last 4 years (see specific data in the enclosures), and this is not expected to increase but will likely continue to decrease.

A-2 Page 13, section 1.42 - Due to the well documented reduction in flows from Phantom Lake Spring, we suggest that enhancement of existing pupfish habitat at Phantom Lake Spring and Canal would be more appropriate than the recommended construction of a refugium canal. A new canal would simply result in the increased loss of water, through evaporation and percolation. One enhancement possibility is the placement of one or two small checks in the canal to replicate conditions existing just upstream of the bench flume wasteway below the spring.

A-3 Page 14, section 1.51 - In the second paragraph, change "Bureau of Reclamation" to "Water and Power Resources Service."

A-4 Page 15, section 1.55 - Water and Power recommended in its memorandum of January 23, 1981, to Director, Fish and Wildlife Service, that certain Water and Power lands be designated critical habitat for the Comanche Springs pupfish (see enclosures).

A-5 Part III, Cost Table - There appears to be a misprint under cost/unit associated with plan designation 1.51. This should read 5,000 and not 25,000.

A-6 Appendix A - We suggest that a population monitoring station be set up at the bench, flume wasteway about 320 feet below Phantom Lake Spring. This would provide for additional data on pupfish populations on Federal land.

Thank you for the opportunity to review the draft recovery plan. If you have any immediate questions, please contact Mr. Alfred W. Hill at (806) 378-5463 or FTS 735-5463.

Robert H. Weiman

Enclosures

REEVES COUNTY WATER IMPROVEMENT DIST. NO 1

DIRECTORS:
R. V. TURNBOUGH. PRESIDENT
CREWS ADAMS. SECRETARY
DAN BRIJALBA
LEE RENZ
ROBERT MCNUTT

P. O. BOX 185
BALMORHEA. TEXAS 79718

JUNE CARTER.
MANAGER

March 13,1981

RD
DRD
AFA
ARW
AEV
CSS
LE
- ACTION -
- FILE

United States Department Of The Interior
Fish and Wildlife Service
P.O. Box 1306,
Albuquerque,New Mexico 87103

Mr. Woody
Acting Assistant Regional Director

Dear Mr. Woody;

I am very sorry to have been so long in responding to gour letter dated February 11,1981.

Our concern would be with 1.4, page 13, under 1.41-- Periodic flooding of irrigation ditches.

B-1 At the present time, the water from Phantom Lake Spring to tho Lower Parks Reservoir is always flowing. Yes we should he consulted as to when and what you intend to do here..

1.42

B-2 Mr Joe, Kingston should be consulted as to this constructing a refugium canal through this area.

1.51

B-3 This also is a concern of ours as to the development and implementation of a comprehensive management plan.

1.53

B-4 Efforts to provide for perennial flow of water from Phantom Lake, San Soloman and Giffin Springs might provide a problem. This would need to be studied as we hardly can agree with this.

On page 16.

3.0

B-5 Under 3.2, we do agree with you on this film, describing tho desert ecosystem of the Balmorhea Area.

Sincerely yours,

June Carter

June Carter,Manager

RECEIVED
REGION 2
OFFICE OF THE
REGIONAL DIRECTOR
MAR 23 1981

FWS REG 2
RECEIVED

SE

T E xA S .

P ARKS AND W ILDLIFE D E pA R T M E N T

CHARLES D. TRAVIS
EXECUTIVE DIRECTOR

4200 Smith School Road
Austin, Texas 78744

March 17, 1981

Mr. Jack B. Woody
Acting Assistant- Regional Director
U. S. Fish and Wildlife Service
Post Office Box 1306
Albuquerque, New Mexico 87103

Dear Mr. Woody:

This is in response to your letter of February 11, 1981, SE, requesting agency review of the draft "Comanche Springs Pupfish Recovery Plan."

C-1

The Department has reviewed the document and recommends as changes those made on the returned draft. These changes are mostly cosmetic or typographical', not substantive.

Thank you -for allowing the Department to comment.

Sincerely,

Charles D. Travis
Executive Director

CDT:FEP:aeh

Enclosure

SE

MAR 19 1981

RESPONSES

A-1: The appropriate explanatory wording was added to the second paragraph, page 5.

A-2: The suggestion was well taken and wording similar to the suggestion was added to section 1.42.

A-3: The change was made.

A-4 : The recovery team does not believe that designation of critical habitat is necessary at this time.

A-5: The correction was made.

A-6: The recovery team believes the monitoring program is adequate for now; however, if after monitoring is underway the need for a change is seen, the suggestion of WPRS will be considered.

B-1/B-5: All appropriate private and public interests wfll be consulted-before any recovery action is taken.

C-l: Appropriate editorial changes were made.

APPENDIXA

The bank observations mentioned below should be made as follows: the observer sits at each of three sites (A, B, C from downstream to upstream, respectively) per station; each site extends 1 m upstream and 1 m downstream from the observer; all territorial males whose territories overlap the observed 2 m section are counted; observations begin with the downstream site A, and proceed upstream to sites B and C.

Except where otherwlse noted, the sample stations designated for seine observations should be sampled as follows: a 5 m segment of stream is blocked with seines of 1/8-3/16 Inch mesh; all pupfish are removed by seining with an 118th inch mesh seine; pupfish are held alive, classified as males, females, or juveniles, each category is enumerated, and all fish are returned alive to the water.

Sample stations.

Phantom Lake Spring

1. Sample Station #4 (Fig. 1)-bank observations.

   Site A: centered 1 m upstream from sluice gate on main canal at Joe Kingston's house.

   Site B: centered 4 m upstream from center of A.

   Site C: centered 4 m upstream from center of B.

2. Sample Station #7 (Fig. 1)-seine observations.

   Seine distal 5 m of the canal or; when through-flowing, a 5 m segment approximately 10 m from the road on south side of the main canal.

San Solomon Springs

3. Pupfish refugium on Balmorhea State Recreation area (not shown in Fig. 1-2)-bank observations.

   Site A: centered 5 m downstream from outlet to the earthen canal (with stations 10 and 11, Fig. 2) is used to drain swimming pool.

   Site B: centered 5 m upstream from above outlet.

   Site C: centered 10 m upstream from above outlet.

4. Sample Station #10 (Fig. 2)--seine observations.

   Seine downstream end of shallow pool.

5. Sample Station #28 (Fig. 2)--modified seine observations.

   Exhaustive effort in 30 m of canal beginning at point of confluence with the inlet canal into Lake Balmorhea. Any suspected C. variegatus or C. variegatus x elegans hybrids should be preserved. C. elegans to be treated as previously described for seine observations.

6. Sample Station #21 (Fig. 2)--bank observations.

   Site A: centered at the metal statue.

   Site B: centered 5 m upstream from center of A.

   Site C: centered 5 m upstream from center of B.

Giffin Springs

7. Sample Station #15 (Fig. 2)--Seine observations.

   This station consists of a relatively natural segment of stream which can be reached by driving or walking a small road which crosses Giffin Canal at #14 (Fig. 2), makes a right turn, and runs alongside Giffin Canal.